Background

Department of Pesticide Regulation
Environmental Monitoring Branch

- Early 1980's & soil fumigants EDB, DBCP, 1,2-D in ground water
- Aldicarb in NY, WI, CA ground water
- Pesticide Contamination Protection Act
  - Science-based
  - Monitoring
  - Data evaluation
  - Physicochemical characteristics
- Prospective pesticides evaluated through modeling

Ground Water Protection Program for Pesticides

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Central Valley Regional Water Quality Control Board

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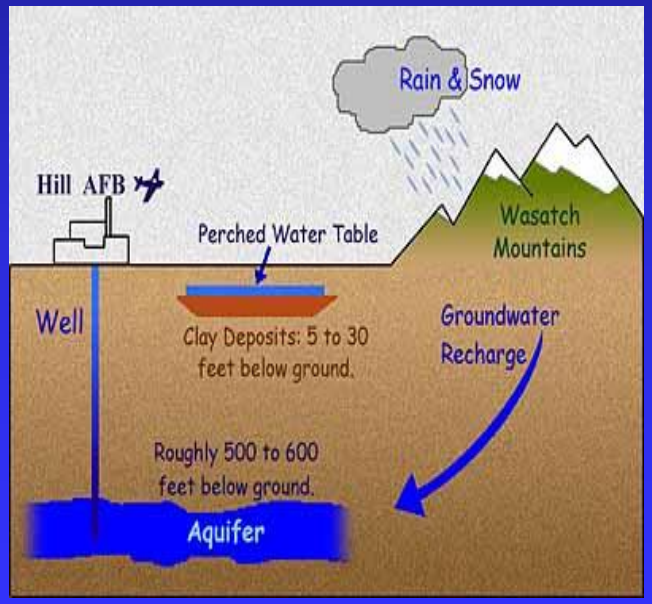
Outline

- Law
- Ground water protection areas
- Regulations to protect GW
- Evaluating new pesticides
- Long term trends



Pesticide Contamination Prevention Act (PCPA)

- Enacted in 1985 to prevent further pollution of ground water due to agricultural use of pesticides

“Pollution”

- Means the introduction into the groundwaters of the state of a pesticide chemical above a level, with an adequate margin of safety, that does not cause adverse human health effects

Agricultural Use in California

PCPA Requirements:

- ✓ Collect environmental fate data for agricultural use pesticides

PCPA Requirements:

- ✓ Use those data to identify pesticides with the potential to pollute ground water (GWPL)
  - SNVs
  - Label language conducive to pesticide movement to ground water

Specific Numerical Values

Mobility related properties:

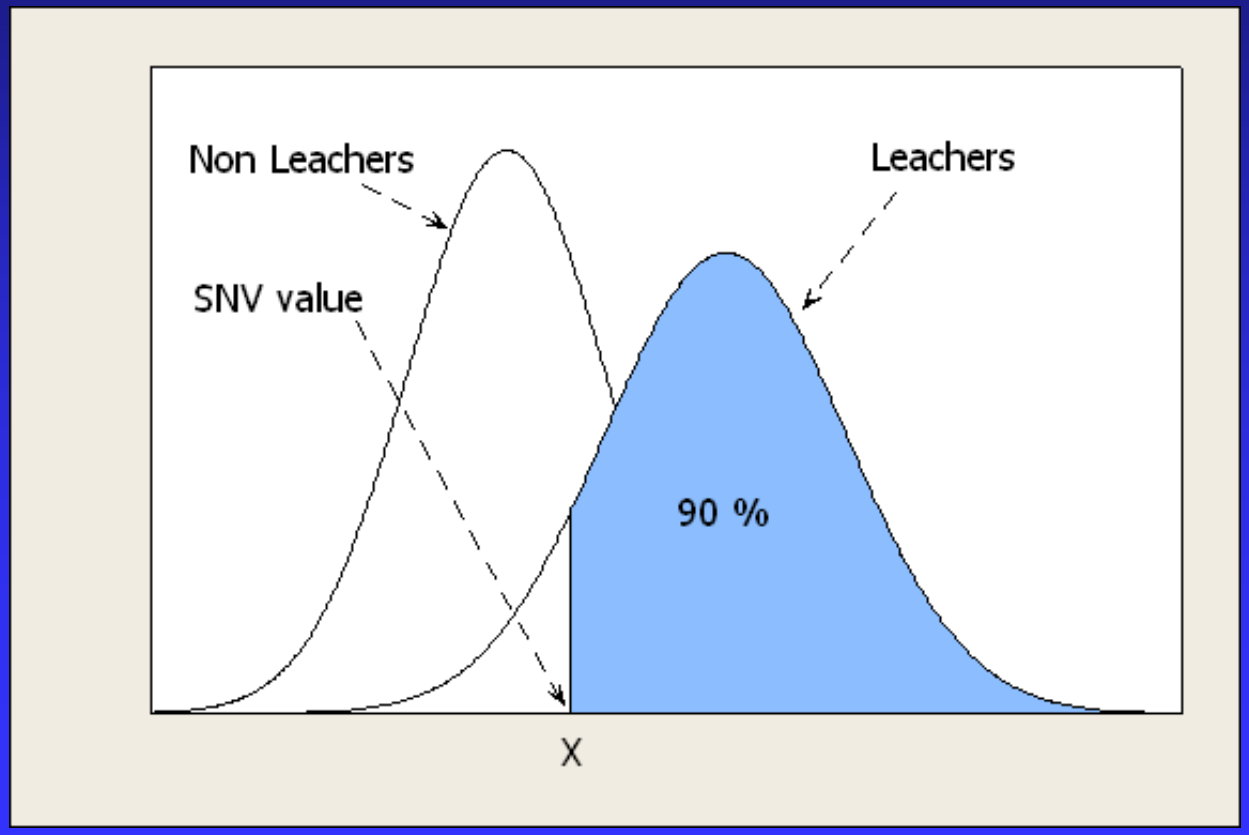
Water solubility =	>3 ppm
Soil adsorption (Koc) =	<1900 cm^3/g

Persistence related properties:

Hydrolysis half-life =	>14 days
Soil anaerobic half-life =	>9 days
Soil aerobic half-life =	>610 days

Ground Water Protection List, California Code of Regulations section 6800

Establishing Trigger Values for Leachers (SNVs)



PCPA Requirements:

- ✓ Collect samples and analyze for those pesticides on the GWPL to determine if they are migrating to ground water

PCPA Requirements:

- ✓ All state and local agencies to submit to DPR results of all wells sampled for pesticides
  - Allows DPR to leverage ground water monitoring resources from other agencies

PCPA Requirements:

- ✓ Maintain a database of pesticide monitoring and provide an annual summary of well monitoring results

Summary of Well Inventory Data Base

	Total	DPR Sampled
Records	2,092,495[a]	70,310
Wells Sampled	23,204	5,610
Wells with Pesticide Residues	4,875[b]	1,464

[a] Data submitted by DPH for municipal wells is major portion of records.

[b] The larger number of total positive wells is due to DBCP detections made in late 1970's and early 1980's.

PCPA Requirements:

- ✓ Determine if a detected pesticide is due to legal agricultural use

PCPA Requirements:

- ✓ Formally review, with recommendations from SWRCB and OEHHA, pesticides found in GW due to legal agricultural use to determine if continued use can be allowed

PCPA Requirements:

- ✓ Adopt regulations to modify use if necessary to protect ground water

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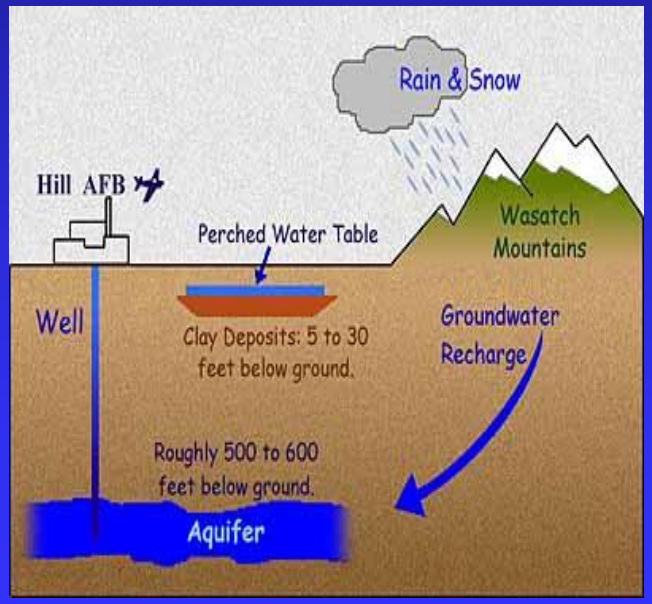


Identify Ground Water Protection Areas (GWPAs)

- CALVUL model developed by DPR
- Based on pesticide detections

  or

- Specified soil types[1,2] and

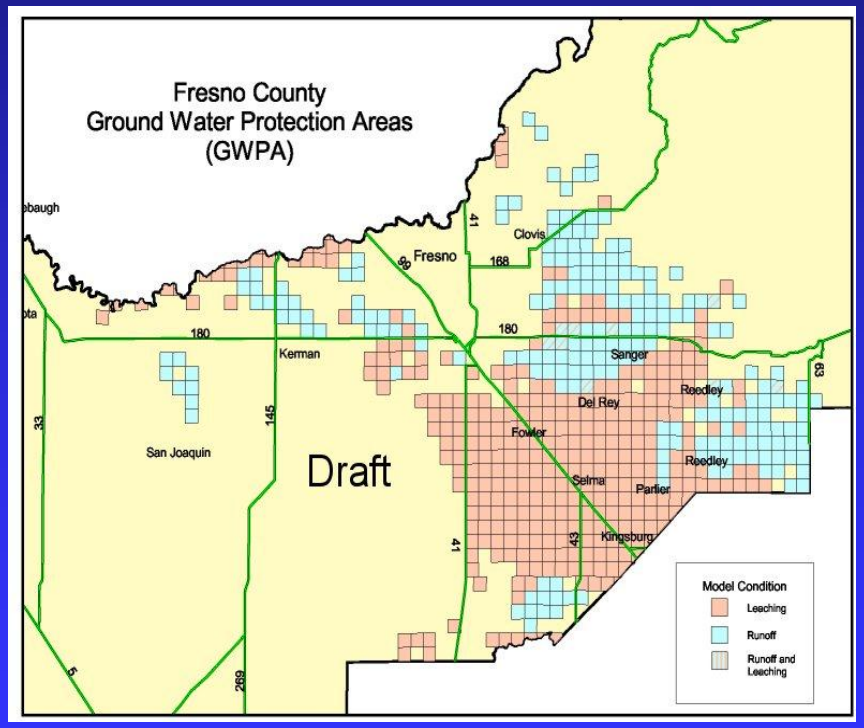
  a depth to ground water of 70 feet or shallower

[1]Troiano, J., et al. 1994. **Use of cluster and principal component analyses to profile areas in California where ground water has been contaminated by pesticides.** Environ. Monitor. Assess. 32: 269-288.

[2] Troiano, J., C. Nordmark, T. Barry, and B. Johnson. 1997. **Profiling areas of Ground Water Contamination by Pesticides in California: Phase II - Evaluation and Modification of a Statistical Model**. Environ. Monitor. Assess. 45:301-318.

Types of GWPAs

- Leaching – coarse soils with high water infiltration rates & shallow GW
- Runoff – hardpan and some clay soils with low water infiltration rates & shallow GW



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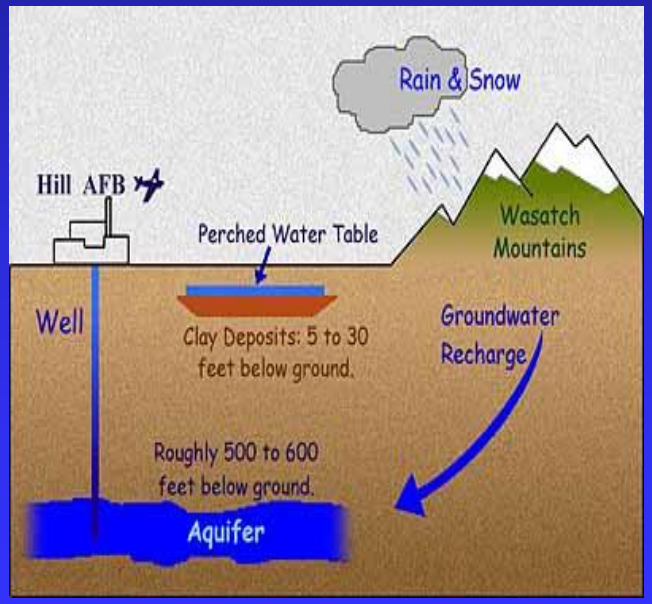

Permits from the County Agricultural Commissioner

- Require operator to get a permit to use atrazine, bentazon, bromacil, diuron, norflurazon, prometon or simazine in GWPAs
- Permit must be conditioned with one of the enforceable management practice options

Leaching GWPAs – 3 Enforceable Management Practice Options

- Control irrigation water
  - No irrigation for 6 months, or
  - Irrigate away from the treated site
  - Manage irrigation efficiently[1]

[1]Troiano, J., et al. 1993. **Influence of Amount and Method of Irrigation Water Application on Leaching of Atrazine**. J. Environ. Qual. 22: 290-298.

Runoff GWPAS - 7 Enforceable Management Practice Options

In general:

- Incorporate the pesticide[1], or
- Manage contaminated runoff water by recirculating back onto field

[1]Troiano, J. and C. Garretson. 1998. **Movement of Simazine in Runoff Water from Citrus Orchard Row Middles as Affected by Mechanical Incorporation**. J. Environ. Qual. 27: 488-494.

Statewide requirements – all pesticides

- Protect wellheads[1]
- Use backflow prevention devices[2]

[1] 3CCR section 6609

[2] 3CCR section 6610

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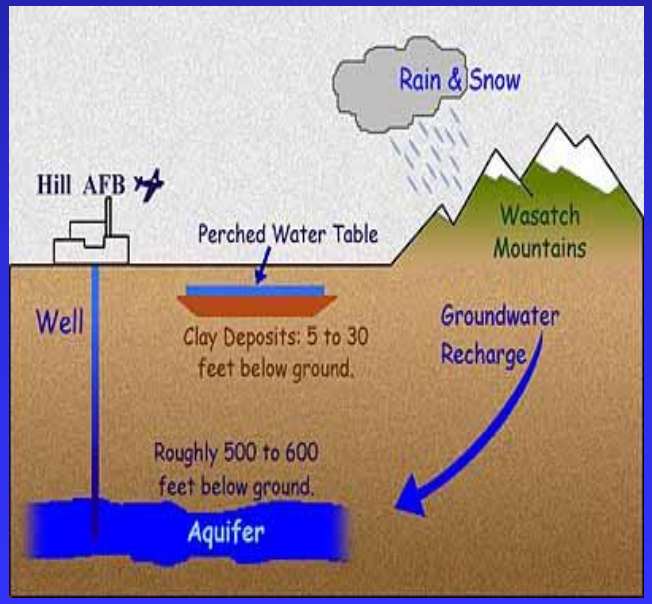


Evaluation of New Products/Uses

- SNV classification
- Review of field study data e.g. field dissipation studies, ground water monitoring studies, lysimeter studies
- Computer modeling to estimate leaching potential in vulnerable California soils[1]

[1]Spurlock, F. 2000. Effect of irrigation scheduling on movement of pesticides to ground water in coarse soils: Monte Carlo analysis of simulation modeling. Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, State of California.

Probabilistic Approach for Leaching Potential

Distributional input

- Soil adsorption values
- Field dissipation rate

→ Mass leached below root zone (multiple simulations) ←

Input constants

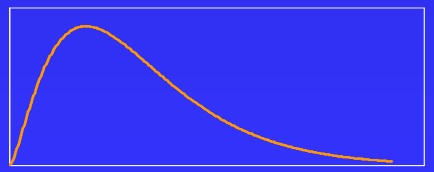
- Chemical application
- Water applications
- Chemical properties
- Climate data
- Soils data
- Hydraulic properties

↓

Residues dissipated in vadose zone and groundwater aquifer

↓

Distribution of concentration in well water

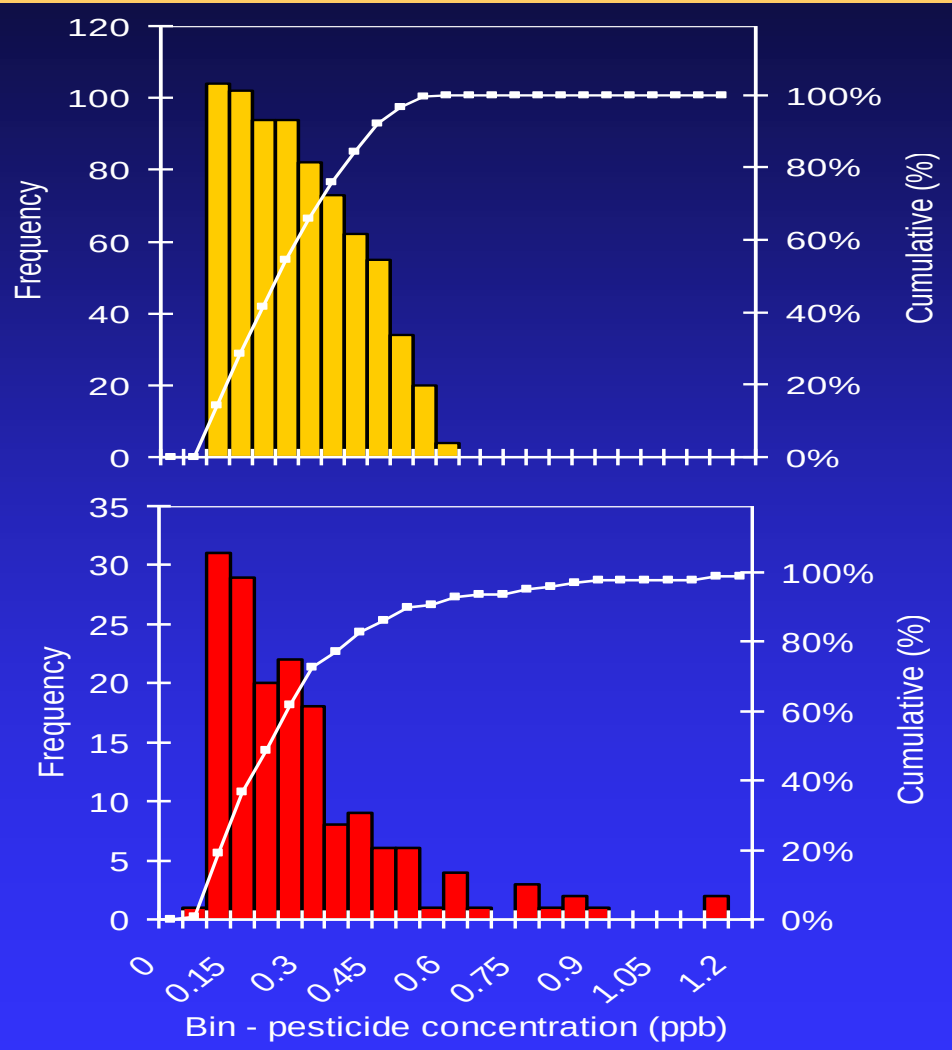


← Not a leacher – No further action.

→ Potential leacher – More data required or mitigation action necessary

Verification of Probabilistic Model

(Atrazine, Simazine, Diuron, Norflurazon, Bromacil, Hexazinone)



Model predictions

- 25th percentile = 0.14 ppb
- 50th percentile = 0.23 ppb
- 75th percentile = 0.35 ppb
- 95th percentile = 0.48 ppb

Observed data

- 25th percentile = 0.12 ppb
- 50th percentile = 0.21 ppb
- 75th percentile = 0.32 ppb
- 95th percentile = 0.74 ppb

Spurlock, F. 2000. Effect of irrigation scheduling on movement of pesticides to ground water in coarse soils: Monte Carlo analysis of simulation modeling. Environmental Hazards Assessment Program, Environmental Monitoring and Pest Management Branch, Department of Pesticide Regulation, State of California.

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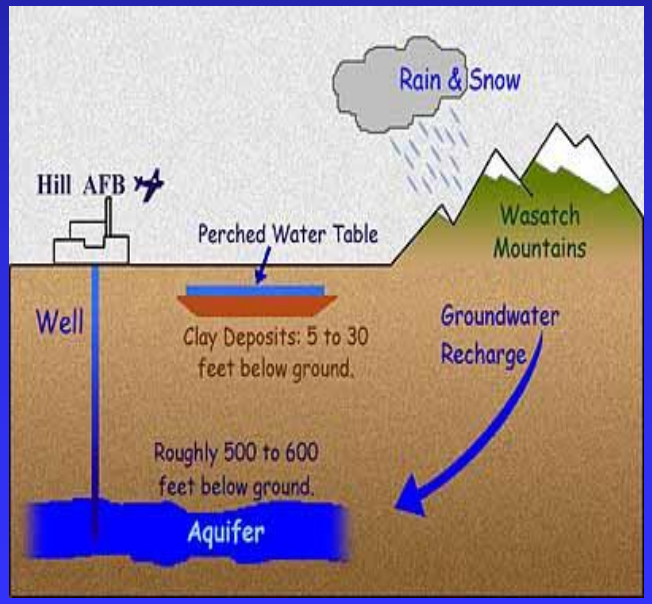
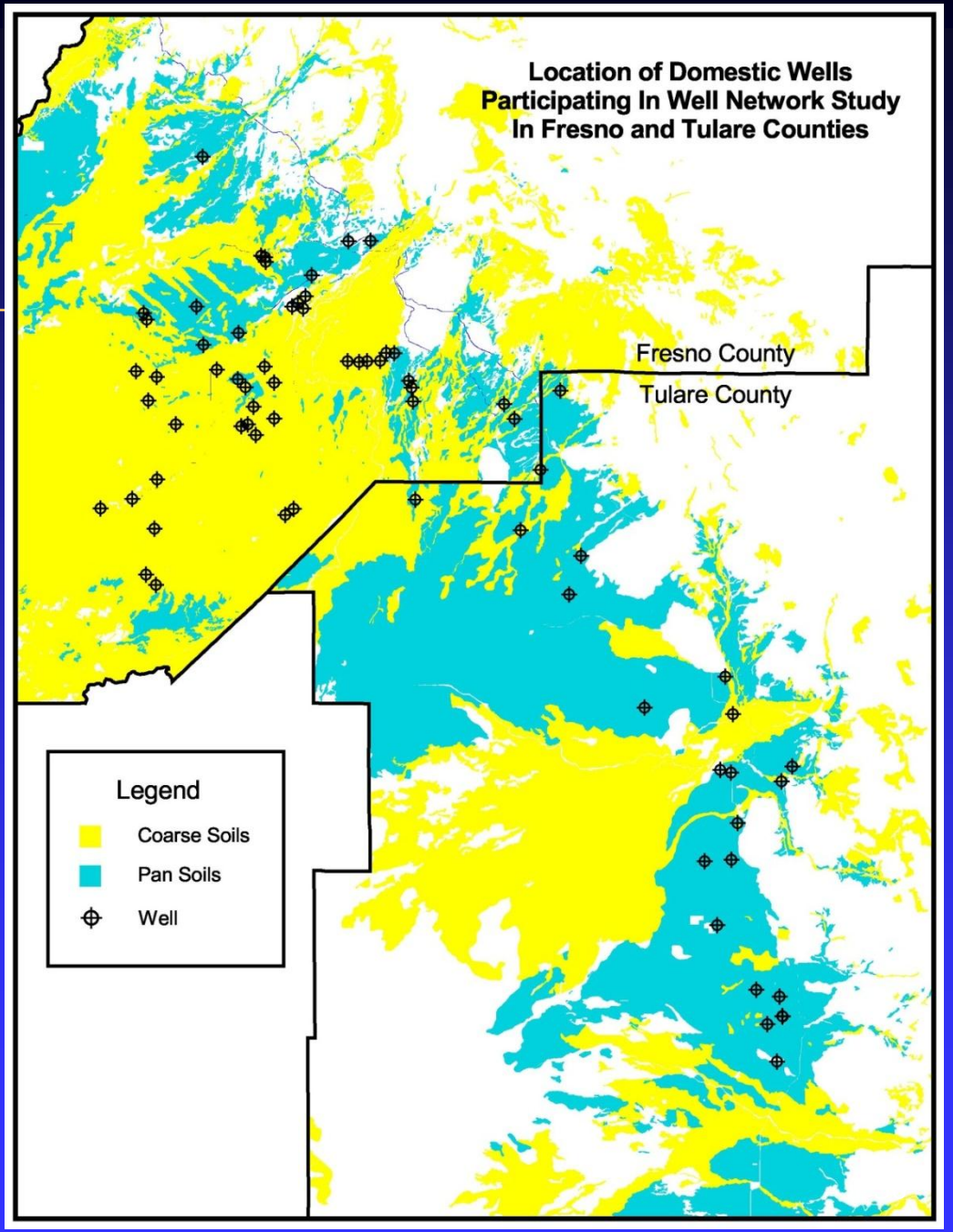


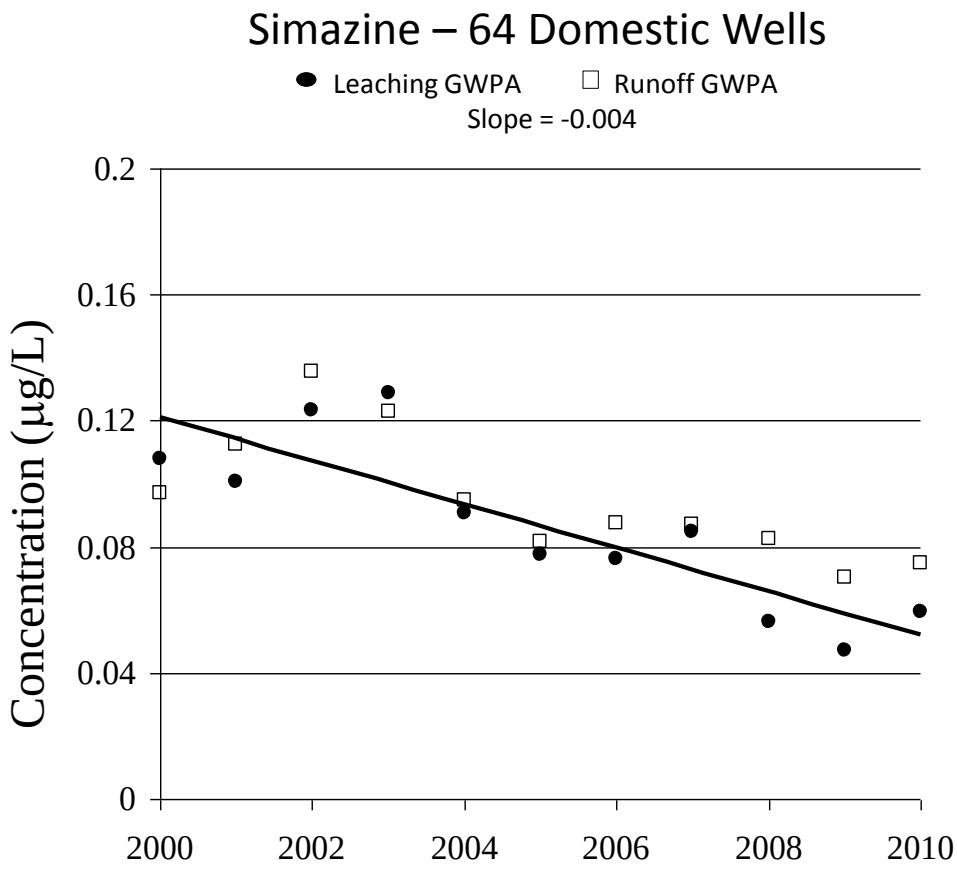
Well Network

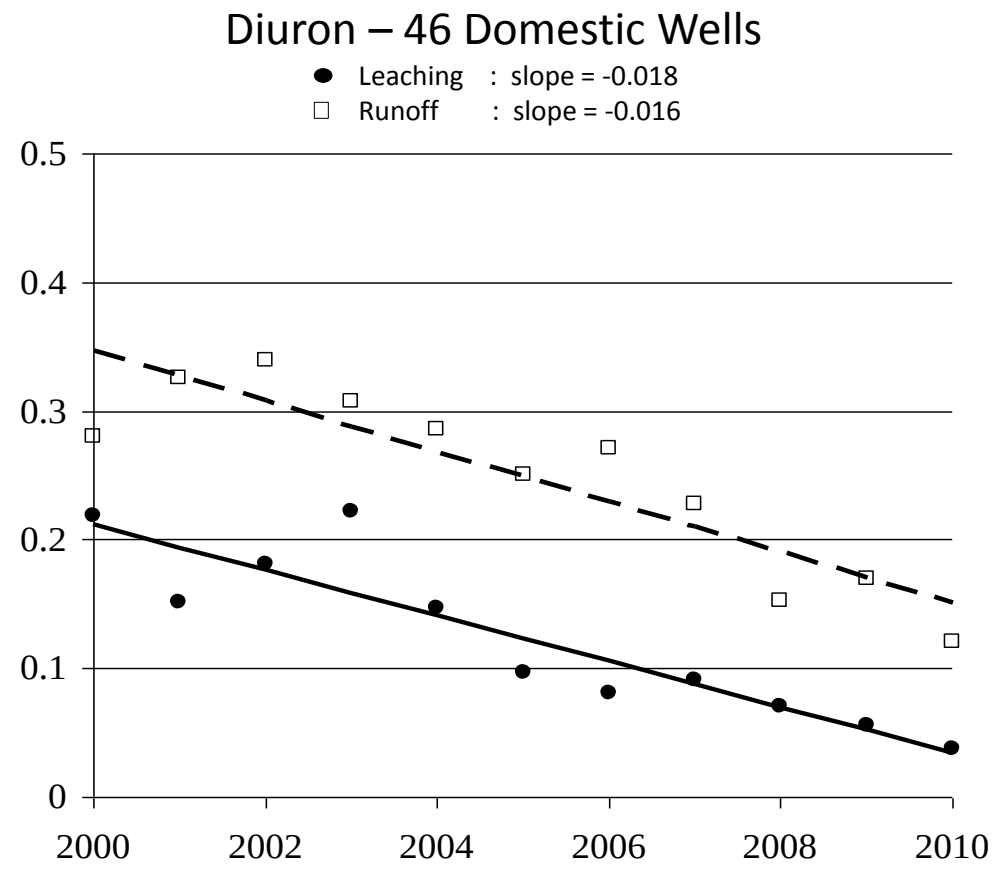
- Monitoring ~70 domestic wells
- Measuring effectiveness of regulations



Troiano ,et al. Association Between Regulation and Pesticide Concentration in Domestic Water Wells in Fresno and Tulare Counties, California. Submitted to Journal of Environmental Quality

Domestic Monitoring Well Network
Overall Analysis





Year